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PROCEEDINGS.

Six hundred and eighty-first Meeting.

May 25, 1875. — ANNUAL MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read a letter from Mr. R. C. Winthrop, accepting his appointment as a delegate to the International Congress of Geographical Sciences; and, at his suggestion, Mr. J. I. Bowditch was appointed a second delegate to this Congress.

The Treasurer presented his report, which was accepted, and on his motion it was

Voted, To appropriate for the general expenses of the Academy, during the coming year, twenty-one hundred dollars ($2100).

The Chairman of the Rumford Committee presented his report, which was accepted; and, in accordance with its suggestion, it was

Voted, That an appropriation of fifteen hundred dollars ($1500) be made from the income of the Rumford Fund for the coming year, to finish the publication of Count Rumford's works.

Voted, That the Librarian and Treasurer of the Academy be authorized to sell to each Resident Fellow one, and one only, complete set of Rumford's Works, including the Life, for five dollars, and to settle on this basis the account of those Fellows who have already purchased the earlier volumes.

Voted, That ten complete sets of Rumford's Works, including the Life, be presented to Professor W. R. Nichols, as an acknowledgment of his services to the Academy.

Voted, That the sum of two hundred and ninety-one dollars ($291) be appropriated from the income of the Rumford Fund to cover the cost of publishing the papers on Light and Heat in Volume X. of the Academy's Proceedings.

Voted, That the sum of five hundred dollars ($500) be appropriated from the income of the Rumford Fund, as the said income will permit, to aid Professor John Trowbridge, of Cambridge, in continuing his researches on the improvement of the Magneto-electric Machine and Induction Coil.

Voted, That the Rumford Medal, for the present year, be awarded to Dr. John William Draper, of New York, for his Researches on Radiant Energy.

On the motion of the Corresponding Secretary, it was

Voted, That an appropriation of fifteen hundred dollars ($1500) from the general fund be made to defray the expenses of publication during the year.

Voted, To appoint a committee of five to revise the Statutes of the Academy. The President appointed Messrs. Cooke, Thomas, Washburn, Deane, and Norton, members of this committee.

Voted, To adjourn this meeting to the second Tuesday in June.

The annual election resulted in the choice of the following officers: —

CHARLES FRANCIS ADAMS, *President.*
JOSEPH LOVERING, *Vice-President.*
JOSIAH P. COOKE, JR., *Corresponding Secretary.*
EDWARD C. PICKERING, *Recording Secretary.*
EDMUND QUINCY, *Treasurer and Librarian.*

Council.

John B. Henck,	of Class I.
Wolcott Gibbs,	
Charles W. Eliot,	
Alexander Agassiz,	of Class II.
John A. Lowell,	
Benj. E. Cotting,	
George E. Ellis,	of Class III.
Andrew P. Peabody,	
Francis Parkman,	

Rumford Committee.

Morrill Wyman.
Wolcott Gibbs.
Josiah P. Cooke, Jr.
James B. Francis.
John M. Ordway.
Stephen P. Ruggles.
Edward C. Pickering.

Committee on Finance.

Charles Francis Adams,	*ex officio.*
Edmund Quincy,	

Thomas T. Bouvé.

The following Committees were appointed on the nomination of the President: —

Committee on Publication.

Alexander Agassiz.
W. W. Goodwin.
John Trowbridge.

Committee on Library.

Charles Deane.
Henry P. Bowditch.
William R. Nichols.

Auditing Committee.

Henry G. Denny.
Robert W. Hooper.

Six hundred and eighty-second Meeting.

June 8, 1875. — ADJOURNED ANNUAL MEETING.

The PRESIDENT in the chair.

The President announced the death of M. Charles de Rémusat, Foreign Honorary Member.

The Corresponding Secretary read a letter from M. Barrande, acknowledging his election into the Academy.

Voted, To adjourn the meeting in August to the second Tuesday in October.

The following papers were presented: —

"On the Hexatomic Compounds of Cobalt." By Dr. Wolcott Gibbs.

"On the Supposed Perchloride of Manganese." By Professor J. P. Cooke, Jr.

"On the Use of Field Instruments in Astronomy." By Professor T. H. Safford.

"On Photographing Spectrum Lines." By Dr. Robert Amory.

"On a Comparison of Prismatic and Diffraction Spectra." By Professor E. C. Pickering.

"On a New Method of Calibration." By Professor E. C. Pickering.

"On a New Instrument for Projecting Lissajou's Curves." By Professor E. C. Pickering.

On the "Theory of Discount in the Game of Billiards." By Professor Benjamin Peirce.

Professor William Watson presented a set of models illustrating his "Descriptive Geometry."

Six hundred and eighty-third Meeting.

October 12, 1875. — ADJOURNED STATED MEETING.

The VICE-PRESIDENT in the chair.

The Vice-President announced the death of Professor Joseph Winlock, and Mr. Chauncey Wright.

The following papers were presented: —

" On a New Property of Conic Sections." By Professor Benjamin Peirce.

" On the Method of Least Squares." By Professor T. H. Safford.

Mr. W. A. Rogers described some further investigations he had made on the lines of Nobert, and presented a paper by M. Trouvelot, " On Veiled Sun-Spots."

The following papers were presented by title : —

" On the Flora of Guadalupe Island." By Sereno Watson.

" Remarks on Magnetic Distribution." By Professor H. A. Rowland.

Six hundred and eighty-fourth Meeting.

November 10, 1875. — STATED MEETING.

The PRESIDENT in the chair.

Mr. W. A. Rogers was appointed Secretary *pro tempore.*

Upon the recommendation of the Council, the following gentlemen were elected members of the Academy : —

Andrew Crombie Ramsay, of London, to be a Foreign Honorary Member in Class II., Section 1, in place of the late Sir Charles Lyell.

Alfred M. Mayer, of Hoboken, to be an Associate Fellow in Class I., Section 3.

Frederick A. Genth, of Philadelphia, to be an Associate Fellow in Class II., Section 1.

Joseph LeConte, of San Francisco, to be an Associate Fellow in Class II., Section 1.

Othniel Charles Marsh, of New Haven, to be an Associate Fellow in Class II., Section 2.

Daniel C. Gilman, of Baltimore, to be an Associate Fellow in Class III., Section 2.

William Sellers, of Philadelphia, to be an Associate Fellow in Class I., Section 4.

Albert Nicholas Arnold, of Hamilton, N. Y., to be an Associate Fellow in Class III., Section 2.

Ira Remsen, of Williamstown, to be a Resident Fellow in Class I., Section 3.

Hiram F. Mills, of Lawrence, to be a Resident Fellow in Class I., Section 4.

Robert Thaxter Edes, of Boston, to be a Resident Fellow in Class II., Section 4.

Henry Adams, of Boston, to be a Resident Fellow in Class III., Section 3.

Professor Cooke announced that the fourth and last volume of Count Rumford's Works had been issued from the press.

Mr. R. C. Winthrop made the following Report: —

It has seemed to me proper, Mr. President, that I should make some brief report of what I did, and of what I left undone, under the commission with which the Academy honored me, some months ago, to represent them at the International Congress of Geography in Paris.

Agreeably to a suggestion which I ventured to make to the Secretary, on receiving my own appointment, Mr. Ingersoll Bowditch, then abroad, was afterwards associated with me in the delegation. But I am sorry to say that neither of us found it practicable to be in Paris during the week in which the sessions were held. For myself, I reached there only on the evening of the day on which they were formally closed. It was an occasion of public ceremonial, which I was sincerely sorry to have missed. I regretted much less that I was unable to attend the opening ceremonies, as they took place on Sunday; and, though I do not care to associate myself with too sanctimonious a sabbatarianism, I have always been offended, when abroad, by the habitual selection of Sunday, particularly in Paris, for spectacles and shows of all sorts. Such a course seems almost like an insult to Protestantism, and might well be the subject of remonstrance where the occasion is not of a local character.

I had reported myself, as a delegate from the Academy, previously to my arrival, and my name had been duly entered on the roll of the Congress. Nothing remained, however, for the members to do, except to make a visit to the Sewers of Paris, — a geographical exploration from which I was willing to excuse myself during the heats of August, — and to pay their respects to the Préfet of the Seine, at a formal reception arranged for that purpose.

This latter service I performed, and found a large and brilliant assembly at the palace of the Luxembourg, quite in Imperial style, notwithstanding the Republican element which has recently entered into the institutions of France. The staircase was lined with *gens d'armes* in uniform, a mounted police guarded the gateways, and one of the regimental bands played national airs within the palace. Nothing could have been more cordial and gracious than the welcome given me as a representative of the American Academy by the Préfet, M. Ferdinand Duval; and I had an opportunity of meeting not a few of the literary and scientific celebrities of France, as well as the delegates from other countries.

The next day I proceeded, with my card of membership, and under the escort of my accomplished friend, Colonel Perraud, to visit the *Exposition Géographique*, which had been arranged in those parts of the palace of the Tuileries which had escaped the torches of the Commune. A marvellous and most multitudinous exposition it was, and one which reflected the highest credit on the Geographical Society of France, under whose auspices it was prepared. I could not have believed it possible that any thing so dry, and so little æsthetic, as geography, could furnish the materials for so really interesting and brilliant a show. It was, indeed, an exhibition of many other things besides such as might be supposed to belong to geography proper. Geology, archæology, ethnology, antiquities of every sort, historic and pre-historic, were gathered there, side by side with maps and memorials of the most recent researches of modern travellers and geographers.

My eye lighted, for instance, on a photographic *fac-simile* of the "Mappamondo di Frà Mauro" of 1459, and on copies or originals of not a few other maps, on which there was no America. It was a relief to turn from these and see, as I did, the beautiful chart, published by our Coast Survey, of Boston Harbor, hanging at the very entrance of the little American department.

I remember seeing, too, the War Map used by the heroic Charles XII. of Sweden, and not far off the manuscript notes and maps of the not less heroic Livingston and Speke and other recent explorers of Africa.

A cast of the wonderful Meteorite of Greenland, weighing (the original) twenty thousand kilos, if I remember right, occupied a whole corner of one apartment. *Fac-similes* of Domesday Book and of the black-letter Prayer Book of 1636 attracted my eye in the English division.

This will give a sufficient indication of the somewhat heterogeneous things which were gathered together from all quarters under the banners of geography, recalling that comprehensive, all-embracing description of Cicero: "Omnes etenim artes quæ ad humanitatem pertinent, habent quoddam commune vinculum, et quasi cognatione quâdam inter se continentur."

The archives of all countries, and the museums of all learned societies, had indeed been made tributary, without reserve, to this exposition; and things old and new had been brought forth from private cabinets and public collections to enrich and adorn it.

But I must not leave the impression that Geography proper, so to speak, was without its full representation. Such an array of globes and maps and photographic illustrations of earth and sea and sky could never have been congregated anywhere before. The Russian department was exceedingly rich, and surpassed all others in the number and perfection of the geographical works with which it was crowded. The Prussian or German department was hardly less striking; while the Austrian, Spanish, Portuguese, Italian, Danish, Norwegian, Dutch, Belgian, and Swiss departments contained many most interesting and valuable contributions. England was hardly there in full force, and the American department was small and poorly supplied.

When I alluded to this, however, as I did with regret, the Préfet of the Seine, with true French politeness, replied, "Yes, but we know you are fitly and fully engrossed with your grand Centennial Exposition at Philadelphia next year, which is well worthy of all your attention; and we shall all be interested in its success."

I lay upon the table a printed Catalogue of this remarkable Exhibition, with a few other pamphlets relating to it, which may give the Academy a better idea of its character than I have been able to convey in these cursory remarks.

Before resuming my seat, however, I may be pardoned for alluding to the monument of Count Rumford, which I visited in company with the American Minister, Mr. Washburne. It received some not very considerable damage from a shell which struck it, or exploded near it, during the siege of Paris. It was understood, before I left Paris, that this Academy had passed a resolution for its repair, and such a measure would be a graceful act to be performed by this or some other American instrumentality. Our Minister was anxious to superintend such a repair, if authority should be given him to do so; and I promised to bring the subject to the renewed consideration of the friends and guardians of Count Rumford's memory.

Professor Cooke presented the report of the committee appointed to revise the Statutes of the Academy, and it was

Voted, To lay this report on the table, and make it the special subject of an adjourned meeting; it was also

Voted, That the Corresponding Secretary be requested to print the report, and distribute it among the Resident Fellows.

Voted, To adjourn this meeting, at its close, to the second Tuesday in December.

The following papers were presented: —

"On the Flora of Guadalupe Island." By Sereno Watson.

"On the Proper Motion of η Draconis." By W. A. Rogers.

Six hundred and eighty-fifth Meeting.

December 14, 1875. — ADJOURNED STATED MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters from Messrs. Arnold, Genth, Mayer, and Mills, accepting their election as Fellows of the Academy; also, a letter from Mr. Parkman, declining his election as a member of the Council.

Mr. R. C. Winthrop was elected a member of the Council in place of Mr. Parkman.

The Corresponding Secretary read a petition from the Trustees of the Boston Public Library to the General Government, asking aid toward the publication of a Topical Index of the United States Documents; and it was

Voted, To authorize the President to sign this document in behalf of the Academy.

Dr. Gibbs presented a memorial petitioning Congress to remove the duty on foreign scientific books not in English, Latin, or Greek; and it was

Voted, to authorize the President to sign this memorial.

The report of the committee on the Revision of the Statutes was taken from the table, and its recommendations discussed. But, in accordance with the provisions of the statutes, action was deferred until the next stated meeting.

The following papers were then presented: —

" On the Periodic Changes in Right Ascension." By Mr. W. A. Rogers.

" On the Tempel Nebula in the Pleiades." By Mr. Trouvelot.

" On the Planet Saturn." By Mr. Trouvelot.

" On a New Form of Bunsen Battery." By Dr. Wolcott Gibbs.

" On the Milk Supply of Boston." By Mr. S. P. Sharples.

" On a New Genus of Harpagonella." By Dr. Asa Gray.

Six hundred and eighty-sixth Meeting.

January 11, 1876. — MONTHLY MEETING.

The PRESIDENT in the chair.

The following papers were presented: —

" Improvements in Inland Navigation Resulting from the Introduction of a New System of Movable Dams." By Professor William Watson.

" Description of an Apparatus to Measure Directly the Strain to which the Different Bars of an Iron Lattice Girder are exposed." By Professor William Watson.

" On the so-called Etheric Current." By Professor John Trowbridge.

" On some New Methods of Topographical Surveying." By Professor E. C. Pickering.

Six hundred and eighty-seventh Meeting.

January 26, 1876. — STATED MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters from Messrs.

LeConte, Remsen, Edes, and Gilman, accepting their election as Fellows of the Academy.

On the motion of Professor Washburn, it was

Voted, To discharge the committee on Expert Evidence.

The following gentlemen were elected members of the Academy: —

Charles Edward Hamlin, of Cambridge, to be a Resident Fellow in Class II., Section 3.

Edwin Lawrence Godkin, of Cambridge, to be a Resident Fellow in Class III., Section 3.

Thomas Dwight, Jr., of Boston, to be a Resident Fellow in Class II., Section 3.

Conte Federigo Sclopis di Salerano, of Turin, to be a Foreign Honorary Member in Class III., Section 1, in place of the late Charles de Rémusat.

The proposed amendments to the Statutes and Standing Votes of the Academy, by rule laid over from the last stated meeting, were acted on seriatim. With some amendments they were all adopted, and are incorporated in the new draft of the Statutes and Standing Votes printed at the end of this volume in connection with the Report of the Council.

Professor Watson presented the following papers: —

"A Description of the New Machinery and Processes employed to Obtain a Supply of Water for the Inland Navigation of the Champagne District of France."

"Improvements in the Construction of River Locks, and the Saving made in the Prism of Lift by the Use of Oscillating Liquid Columns."

The following papers were presented by title: —

"On the Effect of Thin Plates of Iron as Armatures to Induction Coils." By Professor John Trowbridge.

"On the Action of Methyl Iodide on Plumbic Urate." By Professor H. B. Hill.

A communication from the Boston Society of Civil Engineers on the introduction of the metric system of weights and measures, was referred to a committee consisting of Messrs. Pickering and Watson.

Six hundred and eighty-eighth Meeting.

February 9, 1876. — MONTHLY MEETING.

PROFESSOR PEIRCE in the chair.

The Corresponding Secretary announced that the Rumford Medal would be ready for presentation to Dr. Draper at the next meeting. He also called attention to the Statutes as revised, copies of which he presented in print.

The following papers were presented: —

"On the Effect of Thin Plates of Iron as Armatures to Induction Coils." By Professor John Trowbridge.

"On a New Form of Mirror Galvanometer." By B. O. Peirce.

"On the Solar Motion and Stellar Distances." By Professor T. H. Safford.

"On some New Forms of Iron Viaducts." By Professor William Watson.

"On two New Machines used in the Construction of Tidal, Coast, and Harbor Works." By Professor Watson.

"On the Occurrence of Odoriferous Glands in the Walking-stick." By Professor S. H. Scudder.

"On the Equal Roots of the Principal Equations of the Circular Perturbations of the Planets as not affecting the Stability of the System." By Professor Benjamin Peirce.

Six hundred and eighty-ninth Meeting.

March 8, 1876. — STATED MEETING.

The Academy met at the house of Mr. John A. Lowell.

The PRESIDENT in the chair.

The Corresponding Secretary read letters from Messrs. Ramsay, Sclopis, Godkin, and Adams, accepting their election as members of the Academy.

Voted, To adjourn this meeting at its close to the second Wednesday of April, and to postpone the *stated* business of the meeting until then.

The Chairman of the Rumford Committee then introduced the *special* business of the evening, and handed to the President the Rumford Medals (in gold and silver), on each of which had been engraved the following inscription: "Awarded by the American Academy of Arts and Sciences to John W. Draper, for his Researches on Radiant Energy. May 25th, 1875."

In presenting the medals, the President said: —

GENTLEMEN OF THE ACADEMY, — The foundation of this Society, you all know, dates back but four years less than a century. It followed close upon the adoption of the form of government of the State itself. Further than this privilege of a corporation, I am not aware that the State has since bestowed any aid to it whatever. During the long period that has intervened, the individual members have steadily and honestly contributed their labors and their money to the advancement of science and of the arts, the evidence of which is to be found as well in the collections of the library as in the long series of their published transactions. We have not been so lucky as to earn the favor of the generous and wealthy at all in the proportion given to some other institutions of the same general character. In point of fact, we have to ascribe our success more to our own energies than to the assistance of patrons. This is no bad sign for the future. The Academy was never in more healthy and vigorous condition than at this moment. The meetings are constantly attended by numbers who appear to give or to receive with interest the many valuable contributions to knowledge which ultimately take their place in the formidable volumes open to the inspection of the world.

Yet it is not to be understood from what I have said that the institution has been altogether without liberal assistance from several sources. The most remarkable instance of a benefaction was perhaps the earliest, that of Benjamin Thompson, better known under the name of Count Rumford, who, eighty years ago, presented to the Academy the sum of five thousand dollars, to be devoted to the stimulation of the study of the various phenomena connected with light and heat, by the presentation of medals of value as honorary rewards to successful research. It is to the credit of the Academy, in these degenerate days, to find that its administration of this property has fully justified the confidence of the donor, the original sum having increased more than fourfold over and above the cost of the medals which have from time to time been awarded to successful investigation of the great subjects proposed for study and examination.

It now becomes my agreeable duty to announce the fact that, after a careful review of the meritorious services of Professor Draper in this great field of inquiry, the committee having the subject in their charge have, for reasons given by them, recommended through their Chairman, that the medals prescribed in the deed of trust should be presented to him as having fully deserved them. It falls to my lot only to recapitulate in brief some of these reasons.

In 1840 Dr. Draper independently discovered the peculiar phenomena commonly known as Moser's images, which are formed when a medal or coin is placed upon a polished surface of glass or metal. These images remain, as it were, latent, until a vapor is allowed to condense upon the surface, when the image is developed and becomes visible.

At a later period he devised the method of measuring the intensity of the chemical action of light, afterwards perfected and employed by Bunsen and Roscoe in their elaborate investigations. This method consists in exposing to the source of light a mixture of equal volumes of chlorine and hydrogen gases. Combination takes place more or less rapidly, and the intensity of the chemical action of the light is measured by the diminution in volume. No other known method compares with this in accuracy, and most valuable results have been obtained by its use.

In an elaborate investigation, published in 1847, Dr. Draper established experimentally the following important facts: —

1. All solid substances, and probably liquids, become incandescent at the same temperature.
2. The thermometric point at which substances become red-hot is about 977 Fahrenheit degrees.
3. The spectrum of an incandescent solid is continuous; it contains neither bright nor dark fixed lines.
4. From common temperatures nearly up to 977° Fahrenheit, the rays emitted by a solid are invisible. At that temperature they are red, and the heat of the incandescing body being made continuously to increase, other rays are added, increasing in refrangibility as the temperature rises.
5. While the addition of rays, so much the more refrangible as the temperature is higher, is taking place, there is an increase in the intensity of those already existing.

Thirteen years afterward, Kirchhoff published his celebrated memoir on the relations between the coefficients of emission and absorption of bodies for light and heat, in which he established mathematically the same facts, and announced them as new.

Dr. Draper claims, and we believe with justice, to have been the first to apply the daguerreotype process to taking portraits.

Dr. Draper applied ruled glasses and specula to produce spectra for the study of the chemical action of light. The employment of ruled metallic specula for this purpose enabled him to avoid the absorbent action of glass and other transparent media, as well as to establish the points of maximum and minimum intensity with reference to portions of the spectrum defined by their wave lengths. He obtained also the advantage of employing a normal spectrum in place of one which is abnormally condensed at one end and expanded at the other.

We owe to him valuable and original researches on the nature of the rays absorbed in the growth of plants in sunlight. These researches prove that the maximum action is produced by the yellow rays, and they have been fully confirmed by more recent investigations.

We owe to him, further, an elaborate discussion of the chemical action of light, supported in a great measure by his own experiments, and proving conclusively, and, as we believe, for the first time, that rays of all wave lengths are capable of producing chemical changes, and that too little account has hitherto been taken of the nature of the substance in which the decomposition is produced.

Finally, Dr. Draper has recently published researches on the distribution of heat in the spectrum, which are of the highest interest, and which have largely contributed to the advancement of our knowledge of the subject of radiant energy.

And now, in the absence of Dr. Draper, unable at this inclement season to execute a fatiguing journey, it gives me pleasure to recognize you, Mr. Quincy, as his worthy and competent representative.

I pray you, in receiving these two medals on his behalf, in accordance with the terms of the original trust, to assure him, on the part of the Academy, of the high satisfaction taken by all its Fellows in doing honor to those who, like him, take a prominent rank in the advance of science throughout the world.

Mr. Quincy, on receiving the medals, said: —

Mr. President, — In the name and on the behalf of Dr. Draper I have the honor to receive the Rumford Medals in gold and silver, which the Academy has been pleased to award to him, and I will have them safely conveyed to him to-morrow, together with the assurances of the satisfaction of the Academy in this action which you wish me to communicate to him. In common with yourself, Sir, and all the Fellows present, I regret that that eminent person is unable to attend this meeting and receive the medals himself. And, personally, I regret the absence of Dr. Wolcott Gibbs, who had promised to perform this grateful service for his friend, and who would have been able to make a more suitable reply to the able discourse with which you have accompanied the presentation of the medals, and to have done more justice to the claims of Dr. Draper to this distinction than I can pretend to do. Dr. Gibbs having also been unavoidably prevented from being present this evening, I have now the honor to read a communication from Dr. Draper to the Academy, in acknowledgment of this testimony to his services to science.

Mr. Quincy then read the following letter: —

To the American Academy of Arts and Sciences.

Your favorable appreciation of my Researches on Radiations, expressed to-day by the award of the Rumford Medal, the highest testimonial of approbation that American science has to bestow on those who have devoted themselves to the enlargement of knowledge, is to me a most acceptable return for the attention I have given to that subject through a period of more than forty years, and I deeply regret that through ill-health I am unable to receive it in person.

Sir David Brewster, to whom science is under so many obligations for the discoveries he made, once said to me that the solar spectrum is a world in itself, and that the study of it will never be completed. His remark is perfectly just.

But the spectrum is only a single manifestation of that infinite ether which makes known to us the presence of the universe, and in which whatever exists — if I may be permitted to say so — lives and moves and has its being.

What object, then, can be offered to us more worthy of contemplation than the attributes of this intermedium between ourselves and the outer world?

Its existence, the modes of motion through it, its transverse vibrations, their creation of the ideas of light and colors in the mind, the interferences of its waves, polarization, the conception of radiations and their physical and chemical effects, — these have occupied the thoughts of men of the highest order. The observational powers of science have been greatly extended through the consequent invention of those grand instruments, the telescope, the microscope, the spectrometer. Through these we have obtained more majestic views of the nature of the universe. Through these we are able to contemplate the structure and genesis of other systems of worlds, and are gathering information as to the chemical constitution and history of the stars.

In this noble advancement of science you, through some of your members, have taken no inconspicuous part. It adds impressively to the honor you have this day conferred on me, that your action is the deliberate determination of competent, severe, impartial judges. I cannot adequately express my feelings of gratitude in such a presence, publicly pronouncing its approval on what I have done.

I am, gentlemen, very truly yours,

JOHN W. DRAPER.

Professor Watson gave an account of an excursion upon the Marne, with a description of the drum-weirs and river-gates for inland navigation.

Professor Cooke exhibited the radiometer of Professor Crookes, and gave the results of some experiments he had made with it.

Professor William Everett presented a communication on the sources of the Nile. He first called attention to the fact that the wonderful extension of our knowledge in the last few years on this subject had come from explorations directed *from the south*, rather than from the direction of Egypt. In connection with these expeditions, attention had again been directed to earlier discoveries. The veracity of the Portuguese explorers had been attested, and the value of some of the very earliest accounts reasserted. Dr. Livingstone especially had dwelt with great confidence — probably too great — on Herodotus's view of the Nile sources. But a still earlier writer than Herodotus had not received due attention. In the Prometheus of Æschylus, lines 800–815, the wanderings of Io are described with some vagueness, it is true, but in terms which appeared to Professor Everett to indicate a journey to the extreme east, afterwards tending to the south, and approaching Africa from the south-east by a certain *Ποταμὸς Αἰθίοψ*, which he believed to be the Zambesi. The course is then directed along the shore of this, as in Livingstone's second expedition; the central plateau is then entered, as in his last; and the upper falls of the Nile are visited,—as by Speke and Baker,—where it descends *Βυβλίνων ὀρῶν ἄπο,* which Professor Everett thought indicated the vast reaches overgrown by the Byblus reed, so prominently noticed by Sir Samuel Baker.

The date of the Prometheus is approximately 472 before Christ.

Attention was also called to the verifications of the Homeric geography, given by Mr. Gladstone in 1858, and since more accurately worked out in Germany.

Six hundred and ninetieth Meeting.

April 12, 1876.—Adjourned Stated Meeting.

The Vice-President in the chair.

The Corresponding Secretary read letters from Messrs. Hamlin and Marsh, accepting their election as members of the Academy; also, a letter from Mr. E. A. Thompson, of North Woburn, asking aid in securing the house of Count Rumford for public purposes. It was

Voted, To present to the North Woburn Literary Association a copy of the "Life and Works of Count Rumford."

The following gentlemen were elected into the Academy:—

John Langdon Sibley, of Cambridge, to be Resident Fellow in Class III., Section 2.

Henry A. Rowland, of Baltimore, to be an Associate Fellow in Class I., Section 3.

Balfour Stewart, of Manchester, to be a Foreign Honorary Member in Class I., Section 3.

On the recommendation of the Rumford Committee, it was

Voted, To allow the Associate Fellows to purchase copies of the "Life and Works of Count Rumford" at the same rate as the Resident Fellows.

The committee appointed to consider the memorial of the Boston Society of Civil Engineers, regarding the introduction of the metric system, reported, recommending that the President be authorized to sign this memorial. After considerable discussion, it was

Voted, To indefinitely postpone this subject.

The following papers were presented: —

"On George B. Grant's Calculating Machine." By William A. Rogers.

"On the Methods and Precision of Meridian Observations." By Truman H. Safford.

"On a New Form of Induction Apparatus." By Henry P. Bowditch.

"On the Binary System of Arithmetic." By Benjamin Peirce.

Six hundred and ninety-first Meeting.

May 10, 1870. — MONTHLY MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read a letter from Mr. J. L. Sibley, acknowledging his election into the Academy.

The Corresponding Secretary presented the Annual Report of the Council, which was accepted, and is hereto appended.

The following papers were presented: —

"Some Formulæ relating to the Motions of Planets and Comets." By T. H. Safford.

"On the Three Brombenzylbromides." By C. L. Jackson.

"On Telegraphing Musical Sounds." By A. G. Bell.

"On the Perturbations of Uranus by Neptune." By Benjamin Peirce.

Professor Pickering presented the following papers: —

"On the Intensity of Sound." By W. W. Jacques.

"On the Diffraction of Sound." By W. W. Jacques.

Professor Trowbridge presented the following papers by title: —

"On the Change in Conductivity of Copper Wires resulting from Stretching." By G. S. Pine.

"On the Distribution of Magnetism on Armatures." By Harold Whiting.

Dr. Robert Amory exhibited some photographs which he had taken of the Solar Spectrum, in which the D line was for the first time distinctly represented.